Title: Towards a Theoretical Foundation of PID Control

Abstract: Despite of the remarkable progress in modern control theory over the past 60 years, the classical PID (proportional-integral-derivative) controller is still the most widely and successfully used one in various engineering systems. As is well-known, almost all practical control systems are nonlinear with uncertainties, but almost all the existing theoretical studies on PID controller focused on linear systems, where the three PID parameters are usually designed via either experiences or experiments or both. This longstanding gap between the PID theory and its widespread practice calls for establishing of a theory for nonlinear uncertain control systems. The aim of this lecture is to present a theoretical foundation on PID controller for a basic class of nonlinear uncertain systems, by giving a simple and analytic design method for the PID parameters, and by establishing the global stability and asymptotic regulation of the corresponding closed-loop control systems. We will also demonstrate that uncoupled PID feedback loops are indeed capable of dealing with strongly coupled nonlinear uncertain dynamical systems. Several other related issues will also be discussed.

Biography: Lei GUO received his B.S. degree in mathematics from Shandong University in 1982, and Ph.D. degree in control theory from the Chinese Academy of Sciences(CAS) in 1987. He was a postdoctoral fellow at the Australian National University (1987-1989). He has been a Professor of the Institute of Systems Science at CAS since 1992. He has served as President of the Academy of Mathematics and Systems Science, CAS from 2002 to 2012. He is currently the Director of the National Center for Mathematics and Interdisciplinary Sciences, CAS.

Dr. Guo was elected Fellow of the IEEE in 1998, Member of CAS in 2001, Fellow of the Academy of Sciences for the Developing World (TWAS) in 2002, Foreign Member of the Royal Swedish Academy of Engineering Sciences in 2007, Fellow of the International Federation of Automatic Control (IFAC) in 2007. He was also awarded an honorary doctorate by Royal Institute of Technology (KTH), Sweden, in 2014, distinguished lecturer of the IEEE Control Systems Society from 2012 to 2014. Dr. Guo has served as a Council Member of IFAC (2005-2011), General Co-Chair of the 48th IEEE Conference on Decision and Control (2009), Congress Director of the 8th International Congress on Industrial and Applied Mathematics (2011-2015), President

of the China Society for Industrial and Applied Mathematics (CSIAM)(2008-2016), Vice-President of the Chinese Mathematical Society (2004-2007), Vice-President of the Chinese Association of Automation (2002-2013), and member of editorial boards of a number of academic journals in mathematics, systems and control.

His current research interests include PID control theory, nonlinear uncertain systems, distributed adaptive filtering, multi-agent systems, game-based control systems, systematology, among others.